1 Meetings Documentations

1.1 The sixteenth of March, 2015

We had only three hours, much of it with a lacking presence since the graduating students were photographing. This time, we had Nitzan as an instructor. Some important points that had been discussed:

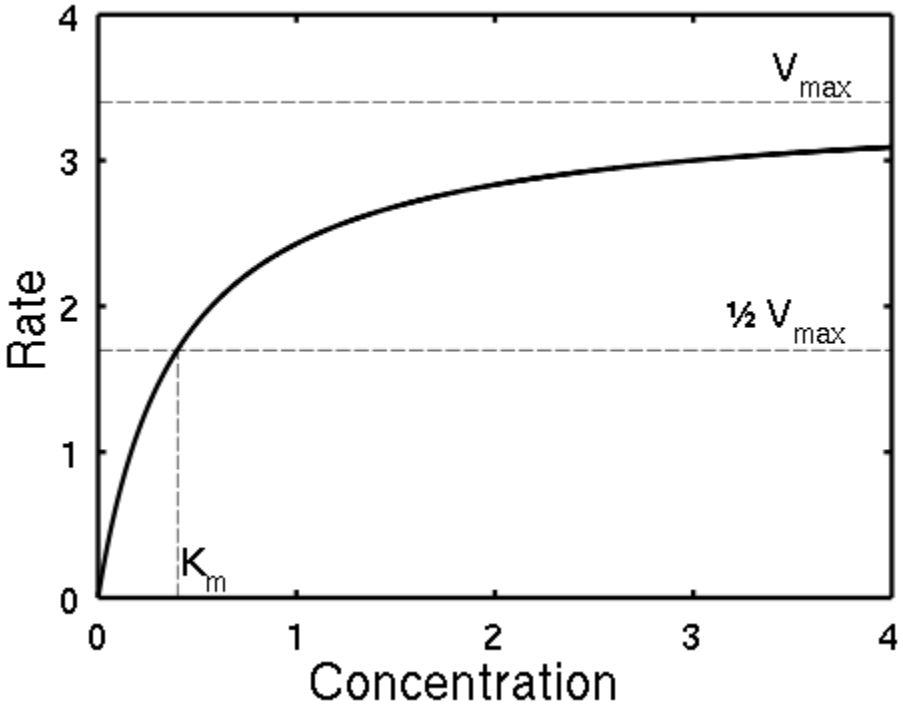
- Problem with constants and descripstion of some reactions: While researching literature for previous computations of the constants we use, I (Itay) noticed that always when describing interactions between aiia and AHL, a different term describes the rate of these interactions other than the one we use in our equations. For example, here the term:

$$-\frac{\gamma_{AHL}[AHL][AiiA]_{in}}{1+g[AHL]}$$

stands for the degradation of AHL by Aiia, While we use in our equations the term:

$$-c_1[AHL][Aiia]_{in}$$

Which is somewhat different. I wouldn't have made a hassle out of it, but it made us unable to use the constants that other researches had computed. In every place I've found describing this reaction, they used the former term, so even if we want we can't get an exact value to the constant of the later term. The reason to this phenomenon is, apparently, the fact that the later model of reaction (which states: {rate of reaction between AHL and Aiia}˜[AHL][Aiia]) is not accurate, and therefore the constant C1 has never been computed. In other words, no one has ever computed the constant C1 because it's not even a constant. The coefficient, instead, behaves like this:



Whence this difference comes from? well, it turns out there is a model named 'Michaelis-Menten kinetics', which describes reactions with enzymes. In short, it states that the rate of reaction of a enzyme E and a substance S is given by

$$r = \frac{V_{max}[S][E]}{K_m + [S]}$$

where V_{max} is the maximal rate achieved by the system and K_m is the concentration of S at which the reaction rate is half of V_{max}. In our problem, Aiia is an enzyme (well, it's not. I think it's the name of the gene that is encoded to the enzyme which degrades AHL. We better find a good biologist and ask him about it) and AHL is the substance. We found some other projects that had used this reaction, and this is the term that they had used. After some dicussion I think that we agreed that we should use this term in our equations. That sets us just for the first term in the first equation, and now we have to check the others as well. I don't think that we'll need to do other corrections, as I don't think that we deal with other enzymatic reactions. To be on the safe side, Nitzan suggested us to google for any two substances X and Y that interact in our system: "reaction constant X and Y", and see in the results whether this reaction exists. An important discovery that has been found this way is this page,

which describes some reactions that interest us, theirs constants and an expression for their flux (rate). For example, the expression for the rate of the reaction $2[AHL : LuxR] \rightarrow [(AHL : LuxR)^2]$ is different from the one that we've got. Also, we need to remember that there are some different kinds of chemical kinetics, for example mass action of different orders besides the aforementioned Michaelis Menten kinetics. Mass action is what we did hitherto, but we didn't considered the orders.

- *SimBiology:* Nitzan suggested using SimBiology, which is a Matlab toolbox specific to biological simulation. We may find a use to it, but currently it is not accessible for us, as it's a commerical product which costs 39$. We'd be able to check it out if we get an access to a computer with it for few hours, but I have no idea where we can find it.

- *Chemistry:* While the older students were photographing, the younger ones discussed with Nitzan an issue regarding the constants. I'm not going to dive too much into it because it's chemistry and such, but basicly they noticed that their chemistry knowledge allows them to compute rate constants of chemical reactions, and our reactions are very similar to chemical ones (most of them even have the same flux equation). This insight gives a way to compute the constants by expirement, but it leads to a contradiction with the units for part of the reactions. [Tomer and Matar: you are welcome to complete this description].

Things that have been done during the following week:

- I wrote a *graphical user interface* for the simulation programme I've written in Matlab. You can download the matlab code package here and here you have usage instruction. You'll need Matlab to run it, though.